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MONTHLY PROGRESS REPORT  
COUNTERMEASURES TRANSMITTING SET AN/ALT-22(V)  
AND  
BARRAGE JAMMER QRC-139A-(T)  
MODIFICATIONS TO AN/ALT-6B

Contract AF33(604)38334

LMED Requisition 32634

PERIOD ENDING: 31 AUGUST 1962

Prepared for  
AERONAUTICAL SYSTEMS DIVISION  
WRIGHT PATTERSON AIR FORCE BASE  
OHIO

SEP 18 1962

TISIA

Prepared by  
GENERAL ELECTRIC COMPANY  
LIGHT MILITARY ELECTRONICS DEPARTMENT  
UTICA, NEW YORK

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## SECTION I

### INTRODUCTION

This report describes the progress made during August 1962 on the development of an L-band oscillator group for the QRC-139A-(T) and AN/ALT-22(V) jamming system. This work includes the development of two essential microwave components, an L-band barrage magnetron and an L-band ferrite load isolator.

The construction and bench testing of QRC-139A-(T) systems and the construction and qualification testing of three L-band AN/ALT-22(V) systems are also part of the program authorized by letter contract AF33(604)38334.

## SECTION II

### AN/ALT-22(V) AND QRC-139A-(T) MODIFICATION TO AN/ALT-6B (L-BAND)

#### A. EQUIPMENT DESCRIPTION.

The equipment being procured under contract AF33(604)38334 consists of sixty government furnished AN/ALT-6B equipments modified to the QRC-139A-(T) and AN/ALT-22(V) configurations. Fifty-seven QRC-139A-(T) equipments complete with L-band QRC-139A-1-(T) oscillator groups are to be supplied with deliveries starting in August 1962. Three first article AN/ALT-22(V) equipments complete with L-band oscillator groups are scheduled to be submitted to first article tests during August and September 1962 and the first article systems delivered to the Air Force by 30 September 1962.

The QRC-139A-(T) equipment supplied on this contract will be identical to the QRC-139A-(T) equipment delivered on contract AF33(604)36722 with the exception that the control dials on the control-indicator and magnetron frequency control units will be designed for L-band and the r-f oscillator will have an L-band barrage magnetron and load isolator.

B. PROGRAM STATUS.

The status of the QRC-139A equipment modification is summarized in the following table.

<u>QRC-139A Unit</u>	<u>Total Units Shipped to Date</u>	<u>At Assembly</u>	<u>At Test</u>	<u>Remarks</u>
Power Supply	20		31	
Transmitter	20		33	
Oscillator	20	2	1	41 Isolators Received 24 Magnetrons Received
Control, Magnetron Frequency	20	6	30	
Control Indicator	20	17	21	
Video Board, Part of Transmitter	20		27	29 BX-1202 Noise Tubes Received
Spare Isolators	5			
Spare Barrage Magnetrons	1			

The first article tests which were scheduled to start in August were delayed because of the barrage magnetron problem. An insufficient number of satisfactory magnetrons was received in August to start the tests as planned. First article tests on Samples 1 and 3 will start early in September providing first article barrage magnetrons are available. Temperature-altitude, explosion proof, and some vibration tests will be run on Sample 1. A 250-hour life test and 24-hour stability test will be run on Sample 3. Service condition tests will be run on Sample 2.

Negotiations are underway with the Air Force to conduct a vibration survey on one AN/ALT-22 first article system in order to determine how much vibration the equipment will withstand without failing, and to pinpoint the areas where failures will occur. Based on the results of this survey, recommendations can be made regarding ways and means of fixing the equipment so that it will withstand vibration tests conducted in accordance with MIL-T-5422 (modified). If the Air Force approves the planned survey early in September, this vibration test will be run on Sample 2. Barry shock mounts built to Boeing specifications have been received for use in this program. The AN/ALT-22 power supply and transmitter with the L-band oscillator installed will be mounted on these shock mounts during part of the vibration survey. The vibration survey data taking and analysis, and report writing will require six weeks.

Parts required for the modification program, with the exception of the L-3519 barrage magnetron, are being received in large enough quantities to meet the production schedules. The barrage magnetron remains a problem area. (See paragraph C. of this section.) The quantities of noise tubes, load isolators, and barrage magnetrons which have been received are tabulated in the Remarks column of the table on page 3. The BX-1202 noise tubes are now being delivered in accordance with the requirements of G-E Drawing No. 7060620, Revision A (see Appendix A) with the exception that the requirements of notes 9 and 12 of this specification have been waived until such time as the necessary life test data and shelf life data can be accumulated to determine that these requirements are realistic. The BX-1202 beam switching tube is a new noise source. It is being used as a noise generator for the first time on this contract. For this reason, little is known of its life expectancy or



shelf life characteristics. The Burroughs Corporation has agreed to accumulate some data so that these tube characteristics can be included as part of the purchase specification.

C. <sup>\*</sup> PROBLEM AREA.

The barrage magnetron is still the only item limiting the delivery of L-band QRC-139A-(T) systems to the Air Force. Litton did not deliver as many tubes as expected during August due to a low yield situation. The low yield during the first part of the period was caused by slumping and narrow spectrum bandwidth. To improve the yield, several changes were made inside the magnetron. To eliminate the slumping problem, the spacing of the pole pieces from the filament was increased to eliminate possible out-gassing from the pole pieces due to the heat from the filament. To increase the spectrum bandwidth, the coupling to the r-f resonant circuit was increased. These changes were made in the tube design about the middle of the report period and failures due to slumping and narrow bandwidth were reduced significantly. However, with the increased coupling, another problem developed in that the tubes received late in August exhibited a strong tendency to mode at the high frequency end of the tuning range. Litton has been advised of this situation and the General Electric Company will work closely with Litton to resolve this new problem which is reducing the yield from 50 percent to less than 30 percent.

D. PROGRAM FOR NEXT INTERVAL.

The program for the next interval will consist of conducting first article tests on the three AN/ALT-22 (L-band) systems and the assembly and test of at least 27 QRC-139A-(T) systems. The barrage magnetron problem will have to be resolved early in September if the scheduled September deliveries are to be accomplished.

E. FINANCIAL STATUS.

The following is an estimate of the monies that have been expended and committed on Contract AF33(604)38334 as of 31 August 1962:

Expenditures for Engineering Material, Design Effort, Direct Labor, Direct Materials and Support Effort	\$264,361
Gross Commitments and Estimated Liability	\$257,400
Total Expenditures and Commitments	\$521,761

F. OTHER PROJECT ACTIVITY.

Engineering and Material Procurement personnel visited Litton Industries to convince them to build more tubes per day since the tube yield was lower than anticipated. As a result of this trip, Litton agreed to increase their tube starts from three per day to four per day. Additional trips to Litton will be required until an even flow of L-3519 barrage magnetrons from Litton to G.E. has been established.

APPENDIX A

BX-1202 NOISE TUBE SPECIFICATION

(G-E Drawing No. 7060620, Rev. A)

REV NO. A  
A 7060620  
CONT ON SHEET 2 SH NO. 1 OF 10

TITLE  
ELECTRON TUBE

CONT ON SHEET 2 SH NO. 1 OF 10

FIRST MADE FOR

REVISIONS

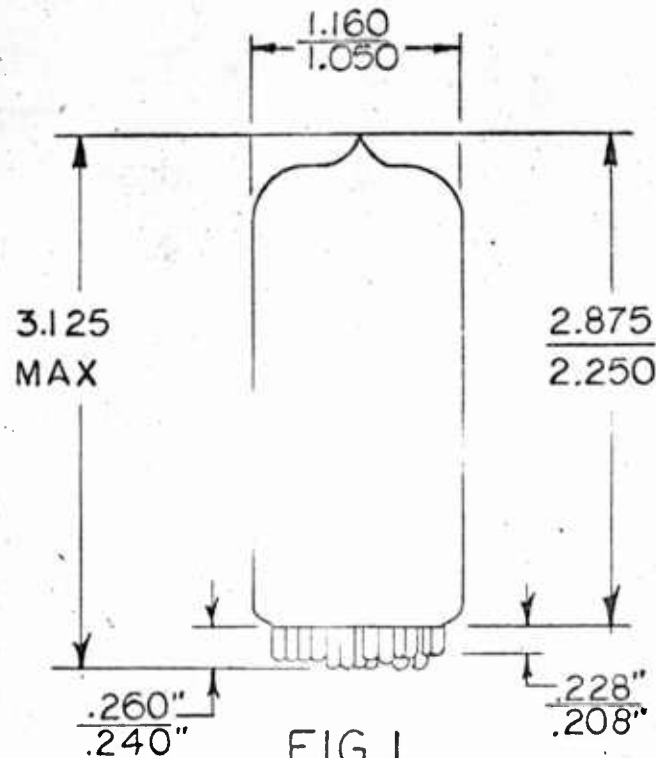


FIG. 1

±.002  
26 PINS .040  
DIA



PIN 18 OMITTED —

ORIGINAL SOURCE OF  
SUPPLY  
BURROUGHS CORP.  
PLAINFIELD, N.J.

BOTTOM VIEW OF TUBE

FIG. 2

VENDOR'S IDENT. NO.  
BX 1202

SPECIFICATION CONTROL DRAWING

MADE BY <i>W. J. Stettin</i> ISSUED June 4, 1962	APPROVALS <i>W. J. Stettin</i> 6/5/62	LME UTICA, N.Y.	DIV OR DEPT.	LOCATION	CONT ON SHEET	SH NO.
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CODE IDENT. NO. 99971

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+ FSC/GE 596045

THIS WAS SH #1  
OF 286 WINN OF 844 N. H.

REV NO. A	TITLE ELECTRON TUBE		CONT ON SHEET 3	SH NO. 2																																																		
A 7060620	FIRST MADE FOR																																																					
CONT ON SHEET 3	SH NO. 2																																																					
<p><u>SPECIFICATION, ELECTRON TUBE TYPE BX 1202</u></p> <p>THIS SPECIFICATION IS BASED ON THE LATEST ISSUE OF MILITARY SPECIFICATION MIL-E-1. ALL PARAGRAPH REFERENCES ARE TO MIL-E-1.</p> <p>DESCRIPTION: WIDE BAND NOISE GENERATING, INTERNAL MAGNETS, HIGH VACUUM.</p> <table border="1"> <thead> <tr> <th>RATINGS:</th> <th><math>E_f</math></th> <th><math>E_o</math></th> <th><math>E_{as}</math></th> <th><math>I_k</math></th> <th><math>E_{bb}</math></th> <th><math>E_{bf}</math></th> <th><math>E_{hk}</math></th> <th><math>E_{ls}</math></th> <th>Amb T (NOTE 1)</th> </tr> <tr> <th>UNITS:</th> <th>V</th> <th>V</th> <th>V</th> <th>ma</th> <th>V</th> <th>V</th> <th>V</th> <th>V</th> <th>°C</th> </tr> </thead> <tbody> <tr> <td>MAX:</td> <td>6.9</td> <td></td> <td></td> <td></td> <td>340</td> <td>+100</td> <td>+100</td> <td></td> <td>+85</td> </tr> <tr> <td>MIN:</td> <td>5.7</td> <td></td> <td></td> <td></td> <td>260</td> <td>-100</td> <td>-100</td> <td></td> <td>-65 NON-OPERATING -55 OPERATING</td> </tr> <tr> <td>TEST CONDITION</td> <td>6.3</td> <td>110</td> <td>172</td> <td></td> <td>300</td> <td></td> <td></td> <td></td> <td>15-30 NOTE 8</td> </tr> </tbody> </table> <p>DIMENSION: SEE FIGURE 1</p> <p>BASE: BUTTON 26 PIN, 10 PIN WITH BURROUGHS TUBE SOCKET SK100 PER DRAWING B74394571 SEE FIGURE 2.</p> <p>PIN CONNECTION: SEE FIGURE 3</p> <p>TEST CIRCUIT: NOTE 3</p>					RATINGS:	$E_f$	$E_o$	$E_{as}$	$I_k$	$E_{bb}$	$E_{bf}$	$E_{hk}$	$E_{ls}$	Amb T (NOTE 1)	UNITS:	V	V	V	ma	V	V	V	V	°C	MAX:	6.9				340	+100	+100		+85	MIN:	5.7				260	-100	-100		-65 NON-OPERATING -55 OPERATING	TEST CONDITION	6.3	110	172		300				15-30 NOTE 8
RATINGS:	$E_f$	$E_o$	$E_{as}$	$I_k$	$E_{bb}$	$E_{bf}$	$E_{hk}$	$E_{ls}$	Amb T (NOTE 1)																																													
UNITS:	V	V	V	ma	V	V	V	V	°C																																													
MAX:	6.9				340	+100	+100		+85																																													
MIN:	5.7				260	-100	-100		-65 NON-OPERATING -55 OPERATING																																													
TEST CONDITION	6.3	110	172		300				15-30 NOTE 8																																													
<p>MADE BY KATHY STADT MAY 31, 62</p> <p>ISSUED JUNE 6, 1962</p> <p>APPROVALS G. WILSON 6/5/62</p> <p>LME</p> <p>UTICA, N.Y. LOCATION</p> <p>DIV OR DEPT.</p> <p>CONT ON SHEET</p> <p>SH NO.</p>																																																						

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REV NO. A	TITLE		CONT ON SHEET 4	SH NO. 3
A 7060620	ELECTRON TUBE			
CONT ON SHEET 4	SH NO. 3	FIRST MADE FOR		

PARA NO.	TEST	CONDITIONS	AQL	INSP	SYM	LIMIT	UNITS
			% DEF	LEVEL		MIN	MAX
FOR MISCELLANEOUS REQUIREMENTS, SEE PARAGRAPH 3.3, INSPECTION INSTRUCTIONS FOR ELECTRON TUBES.							
4.9.18.1.8	**CONTAINER DROP	(1) PACKAGE GROUP 1 CARTON SIZE 4.125X1.812X2.182 MAX					
4.9.6.3	**GLASS STRAIN						
4.9.10	**TEMPERATURE CYCLING	NOT OPERATING 5 CYCLES					
- - -	**VIBRATION	10 TO 55 CPS AT 0.06" TOTAL EXCURSION. 55 TO 2000 CPS AT $\pm 5G$ ACCELERATION. 10 TO 2000 TO 10 CPS IN 2 MINUTES. 15 MINUTES EACH PARALLEL AND AT RIGHT ANGLE TO MAJOR AXIS OF TUBE. NON-OPERATING.					
- - -	**SHOCK	15G $\pm 10\%$ , 11 $\pm 1$ MS DURATION ALONG MAJOR AND MINOR AXIS, NON-OPERATING 3 SHOCKS IN EACH DIRECTION					
4.10.4.1	ANODE CURRENT					1.2	.5 MA DC
4.10.4.5	TARGET CURRENT					1.2 (NOTE 1)	7.0 MA DC
- - -	LAGGING SPADE CURRENT					1.5 (NOTE 1)	.5 MA DC

MADE BY KATHY STAPT FJK ISSUED JUNE 6, 1962	APPROVAL G. W. L. W. 6/5/62	LME UTICA, N.Y.	DIV OR DEPT. LOCATION	CONT ON SHEET	SH NO.
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REV NO. A	TITLE ELECTRON TUBE		CONT ON SHEET 5	SH NO. 4
A 7060620	FIRST MADE FOR			
CONT ON SHEET 5	SH NO. 4			

PARA NO.	TEST	CONDITIONS	AQL % DEF	INSP LEVEL	SYM	LIMIT MIN MAX	UNITS
4.10.8	*HEATER CURRENT				I <sub>f</sub>	135 165	MA
4.10.15	*HEATER-CATHODE LEAKAGE	E <sub>hk</sub> = +100V E <sub>hk</sub> = -100V			I <sub>hk</sub> I <sub>hk</sub>	- -	20 20 μA DC μA DC
-	**NOISE OUTPUT(1)	NOTES 2,3,4,6,10					
-	**NOISE OUTPUT(2)	NOTES 2,3,4,7,10					
-	**NOISE OUTPUT(3)	NOTES 2,3,4,5,8,10					
-	NOISE OUTPUT(4)	F = 5 MC F = 7.5 MC F = 10 MC E <sub>f</sub> = 5.7 VAC E <sub>bb</sub> = 260 VDC NOTES 2,3,4,8,10	1.0	11		96 - 96 - 96 -	DB ABOVE 1μV/MC
-	NOISE OUTPUT(5)	F = 3 MC F = 5 MC F = 10 MC F = 12 MC F = 15 MC F = 20 MC E <sub>f</sub> = 5.7 VAC E <sub>bb</sub> = 260 VAC NOTES 2,3,4,8,10,11	6.5	L8			
4.11	LIFE TEST	GROUP D			t	500	HOURS

MADE BY KATHY STANT ISSUED JUNE 6, 1962	APPROVALS G. WILSON 6/5/62	LME UTICA, N.Y.	DIV OR DEPT. LOCATION	CONT ON SHEET	SH NO.
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REV NO. A	TITLE ELECTRON TUBE		CONT ON SHEET 6	SH NO. 5
A 7060620	FIRST MADE FOR			
CONT ON SHEET 6	SH NO. 5			

PARA NO.	TEST	CONDITIONS	AQL	INSP	SYM	LIMIT	UNITS
			% DEF	LEVEL		MIN	MAX
4.11.4	LIFE TEST END POINTS	F = 5 MC F = 7.5 MC F = 10 MC TARGET CURRENT ANODE CURRENT E <sub>bd</sub> 300 VDC E <sub>c</sub> 6.3 VAC NOTES 2,3,4,5,9,10				95 95 95	DB ABOVE 1μV/MC MA DC MA DC

APPROVALS KATHY STANT JUNE 6, 1962	APPROVALS G. WILBURN 6/5/62	LME UTICA, N.Y.	DIV OR DEPT. LOCATION	CONT ON SHEET	SH NO.
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REV NO. A		TITLE		CONT ON SHEET 7		SH NO. 6	
A 7060620		ELECTRON TUBE					
CONT ON SHEET 7		SH NO. 6		FIRST MADE FOR			

NOTE 1: FOLLOWING ARE DEFINITIONS OF SYMBOLS USED, NOT DEFINED IN MIL-E-1.		REVISIONS	
$I_{TA}$ TARGET CURRENT $E_{BF}$ BEAM FORMING ELEMENT VOLTAGE $\mu V/MC$ MICROVOLTS PER MEGACYCLE  $E_{IS}$ LAGGING SPADE VOLTAGE $I_{IS}$ LAGGING SPADE CURRENT $E_{AS}$ ANODE SUPPLY VOLTAGE			
NOTE 2: IN ORDER TO AVOID POSSIBLE OPERATIONAL CHANGES IN THE CHARACTERISTICS OF THIS TUBE, DO NOT PLACE TUBE IN CLOSE PROXIMITY (LESS THAN 2 INCHES) TO MAGNETIC MATERIALS OR IN A MAGNETIC FIELD STRONGER THAN 15 GAUSS.		AUG 14 1962 2850WINGO T. H. HAN REVISOR	
NOTE 3: TEST PER CIRCUIT IN FIGURE 3 OR AN EQUIVALENT CIRCUIT		A	
NOTE 4: NOISE OUTPUT MEASUREMENTS ARE TAKEN WITH EMPIRE DEVICES NOISE AND FIELD INTENSITY METER, MODEL NF-105. PLUG-IN TUNING UNIT T-A/NF105, .15 TO 30 MC AND SWITCHING UNIT SU-105, USING THE FOLLOWING PROCEDURE: SET SWITCHING UNIT TO "READ". SET RECEIVER FUNCTION SWITCH TO "PEAK". SET "SINE" WAVE OSC-OFF-IMPULSE GEN" SWITCH TO "OFF". SWITCH "SIGNAL INPUT ATTENUATOR" CONTROL TO GET APPROXIMATELY MID-SCALE READING ON THE LARGE METER, KEEPING THE "IF GAIN" CONTROL BELOW ITS HALFWAY MARK. ADJUST "IF GAIN" CONTROL TO READ 0 DB ON THE LARGE METER. THE "IF GAIN" CONTROL SHOULD NOT BE ADVANCED MORE THAN 180° FROM ITS EXTREME COUNTERCLOCKWISE POSITION. TURN THE SWITCHING UNIT TO THE "CALIBRATE" POSITION. SET THE "SINE WAVE OSC-OFF-IMPULSE GEN" SWITCH TO "IMPULSE GEN" POSITION. ADJUST "IMPULSE GENERATOR OUTPUT ATTENUATOR" TO GET READING ON LARGE METER AND WITH "ADD TO IMPULSE GENERATOR OUTPUT" CONTROL, ADJUST LARGE METER TO READ 10 DB, READ NOISE OUTPUT ON "IMPULSE GENERATOR OUTPUT ATTENUATOR" PLUS SMALL METER. IF THE READING IS ABOVE 97 DB, IT IS NECESSARY TO SWITCH THE "SIGNAL INPUT ATTENUATOR" CONTROL DOWN TO THE NEXT LOWER SETTING (20 DB LOWER). ADJUST "IMPULSE GENERATOR		2 PRINTS TO	

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REV NO. A	TITLE		CONT ON SHEET 8	SH NO. 7
A 7060620	ELECTRON TUBE			
CONT ON SHEET 8	SH NO. 7	FIRST MADE FOR		
<p>OUTPUT ATTENUATOR" TO GET READING ON LARGE METER AND WITH "ADD TO IMPULSE GENERATOR OUTPUT" CONTROL ADJUST LARGE METER TO 10 DB, READ NOISE OUTPUT ON "IMPULSE GENERATOR OUTPUT ATTENUATOR" PLUS 20 DB PLUS SMALL METER. THIS REPRESENTS THE NOISE OUTPUT OF THE TUBE IN DB ABOVE 1 MICROVOLT PER MEGACYCLE.</p> <p>NOTE 5 THE NOISE OUTPUT SHALL REMAIN FLAT WITHIN 3 DB AND SHALL NOT FALL BELOW 96 DB ABOVE 1 <math>\mu</math>V/MC AT THE THREE TEST FREQUENCIES WHEN THE ANODE VOLTAGE IS INCREASED TO 117 VOLTS AND DECREASED TO 105 VOLTS. THE LAGGING SPADE VOLTAGE MAY BE ADJUSTED FOR OPTIMUM AT EACH OF THE TWO CONDITIONS.</p> <p>NOTE 6 TAKE REFERENCE READINGS AT 5, 7.5 AND 10 MC AT TEST CONDITION (1) <math>E_f = 6.9V</math>, <math>E_{bb} = 340V</math>, <math>E_{as} = 176V</math>. WHEN TESTED AGAIN AT THE ABOVE FREQUENCIES AND TEST CONDITION (2) <math>E_f = 5.7V</math>, <math>E_{bb} = 260V</math>, <math>E_{as} = 170V</math>, THE NOISE OUTPUT SHALL NOT (A) DECREASE MORE THAN 2 DB IF IT DECREASES (B) INCREASE MORE THAN 4 DB IF IT INCREASES, (C) FALL BELOW 96 DB ABOVE 1 <math>\mu</math>V/MC.</p> <p>THE ANODE VOLTAGE MAY DEVIATE FROM 110V, DUE TO VARIATIONS IN THE ANODE SUPPLY.</p> <p>NOTE 7 WITH THE LAGGING SPADE VOLTAGE (<math>E_{1s}</math>) ADJUSTED PER NOTE 8, THE NOISE OUTPUT SHALL BE FLAT WITHIN 3 DB OVER THE BAND OF 5 TO 10 MC WHEN MEASURED AT 1 MC INCREMENTS.</p> <p>NOTE 8 WITH THE LAGGING SPADE VOLTAGE (<math>E_{1s}</math>) ADJUSTED TO GIVE OPTIMUM NOISE AMPLITUDE AND QUALITY, THE NOISE OUTPUT SHALL BE FLAT WITHIN 3 DB AT THE TEST FREQUENCIES OF 5, 7.5 AND 10 MC.</p>			REVISIONS	
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<p>LME UTICA, N.Y.</p>			<p>DIV OR DEPT. LOCATION CONT ON SHEET SH NO.</p>	
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REV NO.	TITLE	CONT ON SHEET	SH NO.
A 7060620	ELECTRON TUBE	10	9
CONT ON SHEET 10	SH NO. 9	FIRST MADE FOR	

SPEEDS OF .1, 1, 10 AND 100  $\mu$  SEC/CM. AS AN AID IN DETERMINING NOISE QUALITY, BURROUGHS SPECIFICATION PB426, DATED 7/12/62, REVISION 0, TITLED "NOISE OUTPUT QUALITY MEASUREMENTS OF THE TYPE BX1202" MAY BE USED.

FIFTY (50) OHM TERMINATING RESISTOR FOR EMPIRE DEVICES INC., MODEL NF 105, MAY BE REMOVED FROM TEST CIRCUIT FOR EASE OF VIEWING NOISE QUALITY.

NOTE 11 WITH THE LAGGING SPADE VOLTAGE ( $E_{13}$ ) ADJUSTED PER NOTE 8, THE NOISE OUTPUT AT 3 MC SHALL NOT BE MORE THAN 4 DB GREATER THAN AT 5 MC. WITH 10 MC AS A REFERENCE LEVEL, THE NOISE OUTPUT AT 12 MC SHALL NOT BE MORE THAN 4 DB GREATER NOR MORE THAN 15 DB GREATER AT 15 AND 20 MC.

NOTE 12 THE TUBE SHALL HAVE A SHELF LIFE OF AT LEAST 18 MONTHS WHEN STORED UNDER AMBIENT TEMPERATURES NOT TO EXCEED +85°C AND RELATIVE HUMIDITY CONDITIONS NOT TO EXCEED 90 PER CENT.

NOTE 13 THE TUBE SHALL GENERATE SATISFACTORY NOISE OUTPUT AS DEFINED BY TEST LIMITS AND NOTES WHEN OPERATED OVER THE RANGE OF CONDITIONS SPECIFIED IN THE NOTES.

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MADE BY Thomas E. Baker	7-27-62	APPROVALS H. Wilburn	LME	DIV OR DEPT.	UTICA, N.Y.	LOCATION	CONT ON SHEET	SH NO.
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A-10

REV  
NO.

TITLE

A17060620

ELECTRON TUBE

CONT ON SHEET SH NO. 10

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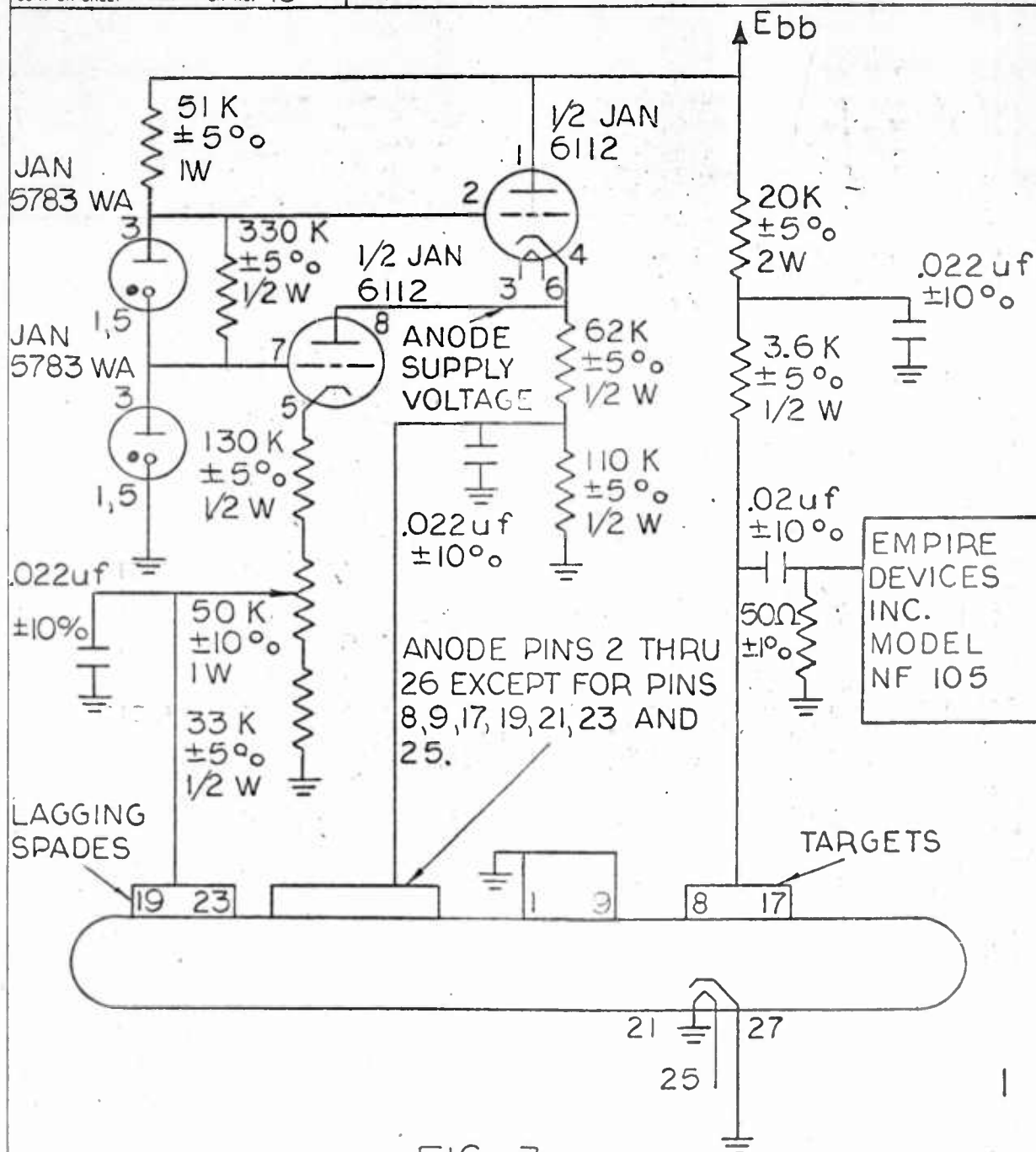


FIG. 3

MADE BY

Thomas E. Melin

7/28/62

APPROVALS

H. Wilbur

8/13/62

L.M.E.

UTICA, N.Y.

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